# TOMATO CULTIVAR EVALUATION

# FOR PROCESSING



**SUBMITTED TO:**

**MID-AMERICA FOOD PROCESSORS ASSOCIATION**
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# TOMATO CULTIVAR EVALUATION FOR PROCESSING

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## OBJECTIVES

To evaluate new tomato cultivars that have already demonstrated positive attributes from a production standpoint to see if they also could produce a quality processed product. The cultivars are evaluated prior to, during and after processing for the major quality attributes.

## PROJECT FUNDING

Mid-America Food Processors Association, Worthington, OH.

## BACKGROUND

New processing tomato cultivars that are under development by OARDC plant breeders have been evaluated for processing quality attributes for over 40 years in an ongoing project in the OSU Food Industries Center pilot plant. If new varieties demonstrate desirable production characteristics, they are placed in the processing trials for from one to several years to see if they produce desirable processing traits.

Initially, the tomatoes were canned as whole tomatoes and tomato juice. Some twelve or thirteen years ago, diced tomatoes were also added to the program. In addition, over the years tomatoes from these trials have been utilized as the raw product for many other processing studies. In recent years, all of these tomatoes have come from the Fremont, Ohio, vegetable research farm.

## PROCEDURES UTILIZED

All tomatoes were grown and mechanically harvested at the OSU Department of Horticulture Research Farm in Fremont, Ohio. The fruit were harvested into steel dumping bins and trucked to the Food Industries Center Pilot Plant located in Howlett Hall.

The following is a flow chart for our Pilot Plant tomato operation:

1) All tomatoes were washed in a soak tank with air agitation.
2) Tomatoes were spray washed with 150 psi water while being conveyed on a roller conveyor.
3) Tomatoes were sorted to remove off quality fruit.
4) Tomatoes for juice were chopped in a Fitzpatrick Mill equipped with a 3/4" screen.
5) Tomatoes were pumped through a tube-in-tube heat exchanger to reach a hot break temperature of 190°F.
6) Tomatoes were extracted in a F.H. Langsenkamp, Inc. Model 157 paddle-type extractor with a .030 screen.
7) The peel and skins discharged from the extractor were sent to a Chisolm-Ryder Model C screw-type extractor-finisher with a .040 screen.
8) Tomatoes for whole or diced product after the spray washer were run through a Fox lye peeler with a peeling solution of approximately 18% lye at 190°F.

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9) Tomatoes were conveyed on a port mat belt to provide approximately a 30-second lye reaction time.
10) Tomatoes were run over a Fox disk peeler for skin removal.
11) Tomatoes were sorted and hand-trimmed and peeled.
12) Tomatoes for dicing were run through an Urschel Laboratories, Inc. Model GK dicer set for 1/2" cubes.
13) All juice, whole tomatoes and diced were filled into a 303 x 406 can, a Morton salt and acid tablet added, closed and processed at 220°F for 30 minutes.

Analytical procedures were conducted on the tomatoes prior to processing, during the processing operation, after the hot break and after the tomatoes had been processed and stored for at least 30 days. The test procedures included the following:

1) The pH was determined by a Beckman Zeromatic pH Meter and total acid was determined by titrating to a pH of 8.1 with 0.1 in sodium hydroxide.

2) Soluble solids were measured on an American Optic Abbey Refractometer.

3) Color was measured on the Agtron ME-5M and the Agtron M35-D colorimeters.

## RESULTS

Table I gives the quality data for the raw product. Table II is the data for tomato juice end process taken immediately after the hot break. Table III provides the data for tomato juice that had been processed for over thirty days.

As always, the particular environmental conditions will impact product quality at harvest. Early spring wet weather conditions caused a delay in plantings. Also, some disease problems associated with local greenhouse plants further delayed planting and in some cases, in fact, actually caused replanting. Both of these conditions caused a delay of seven to ten days in harvest, and also was a major contributor to an overall reduction of fruit size. Toward the end of the season, there also seemed to be a period a week-ten days when fruit was unusually ripe. Some processors found this condition improved right at the end of the season, while others still had to contend with very soft, small fruit. With minor exceptions, the fruit that we processed in the Food Industries Center Pilot Plant this year was of good quality, small size and generally softer than usual.

Generally, the soluble solids were very good with ten cultivars having a soluble solids reading of 5% or better in the finished product. Color also was very good, as demonstrated by both the Agtron ME-5M and the M35-D. For comparative purposes, there were 13 varieties that had an Agtron ME-5M reading of 28 or less (lower number, better score) which would relate to the USDA tomato paste score of 50. There was also only one that had a score of 35 or better, which would provide a paste score of 48. pH values were also running lower than in some previous years which was particularly important because the fruit was very ripe.

## RECOMMENDATIONS

This type of tomato cultivar evaluation should continue, as it does provide valuable data for the tomato processing industry in Ohio and the midwest. This information has been, and will continue to be valuable to the industry as one criteria on which to select new cultivars for future operations.

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# 1994 PROCESSING TOMATO CULTIVAR TRIALS

## TABLE I — RAW PRODUCT

| LOT # | CULTIVAR | COUNT/8 # | pH | % ACIDITY | SOLUBLE SOLIDS | AGTRON M E-5M | AGTRON RED | AGTRON BLUE | M 35-D GREEN | M 35-D YELLOW |
|---|---|---|---|---|---|---|---|---|---|---|
| 01 | PS 696 | 63 | 3.90 | 0.320 | 3.6 | 49 | 42.7 | -1.2 | 2.6 | 2.9 |
| 02 | O 7983 | 57 | 3.93 | 0.320 | 3.5 | 49 | 38.7 | -1.4 | 2.0 | 2.2 |
| 03 | O 8245 | 71 | 3.95 | 0.364 | 2.8 | 42 | 39.1 | -1.3 | 2.1 | 2.1 |
| 04 | O 8556 | 60 | 3.90 | 0.371 | 3.1 | 41 | 36.3 | -1.2 | 2.0 | 2.0 |
| 05 | H 8704 | 66 | 3.90 | 0.396 | 4.0 | 48 | 41.4 | 2.8 | 6.9 | 7.2 |
| 06 | SO 12 | 58 | 3.85 | 0.371 | 3.6 | 49 | 35.9 | -1.4 | 2.0 | 2.1 |
| 07 | SO 47 | 53 | 3.92 | 0.364 | 3.6 | 44.5 | 48.9 | -1.3 | 2.2 | 2.4 |
| 08 | SO 48 | 61 | 3.92 | 0.352 | 3.8 | 45 | 37.3 | -1.4 | 1.8 | 1.7 |
| 09 | OX 38 | 71 | 3.90 | 0.300 | 3.1 | 46 | 38.5 | -1.4 | 1.8 | 1.9 |
| 10 | OX 42 | 66 | 3.92 | 0.339 | 3.6 | 43.5 | 38.2 | -1.4 | 2.0 | 2.0 |
| 11 | OX 52 | 64 | 3.85 | 0.320 | 3.5 | 43 | 36.9 | -1.4 | 1.9 | 1.9 |
| 12 | OX 64 | 71 | 4.03 | 0.294 | 3.1 | 48 | 41.5 | 2.6 | 6.7 | 7.0 |
| 13 | OX 70 | 63 | 4.00 | 0.326 | 3.5 | 51 | 37.8 | -1.4 | 1.9 | 2.0 |
| 14 | OX 72 | 73 | 4.00 | 0.288 | 2.9 | 57 | 45.4 | 2.7 | 6.7 | 6.9 |
| 15 | OX 88 | 66 | 3.95 | 0.320 | 3.4 | 41.5 | 43.1 | 2.6 | 6.2 | 6.2 |
| 16 | OX 120 | 56 | 3.95 | 0.371 | 3.4 | 46 | 36.6 | -1.3 | 1.8 | 1.8 |
| 17 | OX 137 | 58 | 3.95 | 0.332 | 3.5 | 48 | 36.3 | -1.3 | 1.6 | 1.6 |
| 18 | O 86120 | 68 | 3.95 | 0.370 | 3.3 | 49 | 38.6 | -1.2 | 1.9 | 1.8 |
| 19 | O 87160 | 77 | 4.01 | 0.281 | 3.3 | 55 | 44.8 | 2.5 | 6.4 | 6.5 |
| 20 | O 87175 | 67 | 4.00 | 0.371 | 3.7 | 44 | 36.5 | -1.3 | 1.7 | 1.5 |
| 21 | O 88119 | 59 | 3.95 | 0.288 | 2.9 | 45 | 37.0 | -1.2 | 2.6 | 2.4 |
| 22 | O 9241 | 56 | 4.00 | 0.326 | 3.4 | 44 | 36.1 | -1.4 | 1.6 | 1.3 |
| 23 | O 9244 | 56 | 3.90 | 0.339 | 3.4 | 44 | 34.9 | -1.4 | 1.3 | 1.1 |
| 24 | E 3020-1 | 59 | 4.05 | 0.332 | 3.0 | 45 | 37.8 | -1.4 | 1.8 | 1.8 |
| 25 | E 3021-1 | 63 | 4.00 | 0.345 | 3.4 | 46 | 39.5 | -1.3 | 2.1 | 2.2 |
| 26 | E 3030-1 | 57 | 4.00 | 0.358 | 3.9 | 38.5 | 36.5 | -1.3 | 1.8 | 1.8 |
| 27 | E 3045-1 | 59 | 3.90 | 0.339 | 3.2 | 43 | 37.5 | -1.4 | 1.8 | 1.7 |
| 28 | E 3071-1 | 48 | 3.90 | 0.332 | 3.2 | 48 | 35.7 | -1.4 | 1.6 | 1.5 |
| 29 | E 1838-1 | 70 | 3.95 | 0.332 | 3.4 | 44 | 37.6 | -1.4 | 1.9 | 2.0 |
| 30 | E 1849-1 | 60 | 4.00 | 0.300 | 3.6 | 40 | 35.8 | -1.6 | 1.2 | 1.1 |
| 31 | | | | | | | | | | |
| 32 | SO 90 | 71 | 4.00 | 0.352 | 2.8 | 45 | 42.8 | 2.5 | 5.7 | 5.6 |

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# 1994 PROCESSING TOMATO CULTIVAR TRIALS

## TABLE II — PROCESS AFTER EXTRACTION

| LOT # | CULTIVAR | pH | % ACIDITY | SOLUBLE SOLIDS | AGTRON M E-5M | AGTRON RED | AGTRON BLUE | M 35-D GREEN | M 35-D YELLOW |
|---|---|---|---|---|---|---|---|---|---|
| 01 | PS 696 | 3.90 | 0.390 | 3.4 | 32.5 | 36.0 | -1.5 | 1.7 | 1.5 |
| 02 | O 7983 | 4.00 | 0.352 | 3.7 | 35 | 34.9 | -1.5 | 1.7 | 1.5 |
| 03 | O 8245 | 3.80 | 0.544 | 3.6 | 34 | 36.4 | -1.5 | 2.0 | 1.8 |
| 04 | O 8556 | 3.9 | 0.422 | 3.2 | 33.5 | | | | |
| 05 | H 8704 | 3.85 | 0.416 | 4.0 | 34 | 32.2 | -0.3 | 0.3 | 0.2 |
| 06 | SO 12 | 3.85 | 0.409 | 3.7 | 35.5 | 36.2 | -1.2 | 2.4 | 1.9 |
| 07 | SO 47 | 3.88 | 0.441 | 3.7 | 36.5 | 36.5 | -1.4 | 1.9 | 1.8 |
| 08 | SO 48 | 4.05 | 0.352 | 4.0 | 36 | 34.8 | -1.6 | 1.7 | 1.5 |
| 09 | OX 38 | 4.15 | 0.358 | 3.6 | 30 | 35.5 | -1.1 | 2.0 | 1.8 |
| 10 | OX 42 | 4.08 | 0.326 | 3.9 | 29.5 | 35.8 | -1.2 | 2.1 | 1.8 |
| 11 | OX 52 | 4.0 | 0.326 | 3.4 | 34.0 | 36.1 | -1.3 | 2.0 | 1.8 |
| 12 | OX 64 | 3.95 | 0.307 | 3.3 | 39.5 | 32.0 | -0.3 | 0.5 | 0.3 |
| 13 | OX 70 | 4.05 | 0.345 | 3.4 | 32.5 | 35.6 | -1.1 | 2.0 | 1.8 |
| 14 | OX 72 | 3.95 | 0.332 | 3.3 | 37.5 | 32.9 | -0.3 | 0.4 | 0.3 |
| 15 | OX 88 | 4.00 | 0.371 | 3.6 | 34.5 | 31.8 | -0.3 | 0.1 | 0.0 |
| 16 | OX 120 | 4.0 | 0.384 | 3.9 | 31.5 | 35.0 | -1.4 | 1.7 | 1.4 |
| 17 | OX 137 | 4.05 | 0.371 | 4.0 | 29.5 | 34.9 | -1.5 | 1.6 | 1.3 |
| 18 | O86120 | 3.90 | 0.403 | 3.7 | 34 | 35.2 | -1.5 | 1.6 | 1.4 |
| 19 | O87160 | 4.00 | 0.313 | 3.7 | 35.5 | 32.3 | -0.2 | 0.3 | 0.2 |
| 20 | O87175 | 4.0 | 0.441 | 4.4 | 32 | 35.1 | -1.1 | 2.2 | 1.6 |
| 21 | O88119 | 3.9 | 0.236 | 2.8 | 50 | 33.2 | -0.8 | 3.1 | 2.5 |
| 22 | O 9241 | 4.0 | 0.396 | 3.4 | 33.5 | 35.1 | -1.5 | 1.5 | 1.2 |
| 23 | O 9244 | 3.95 | 0.384 | 3.6 | 28.5 | 34.5 | -1.6 | 1.3 | 1.0 |
| 24 | E 3020-1 | 4.20 | 0.288 | 3.1 | 32 | 33.2 | -1.3 | 2.0 | 1.8 |
| 25 | | | | | | | | | |
| 26 | E 3030-1 | 4.05 | 0.384 | 4.2 | 34 | 35.5 | -1.4 | 1.8 | 1.6 |
| 27 | E 3045-1 | 3.95 | 0.377 | 3.3 | 32 | 35 | -1.5 | 1.5 | 1.3 |
| 28 | E 3071-1 | 4.0 | 0.390 | 3.8 | 31 | 34 | 01.4 | 1.4 | 1.2 |
| 29 | E 1838-1 | 4.12 | 0.377 | 4.0 | 32 | 36.1 | -1.2 | 2.0 | 1.8 |
| 30 | E 1849-1 | 4.00 | 0.339 | 4.2 | 29 | 34.0 | -1.6 | 1.3 | 1.0 |
| 31 | | | | | | | | | |
| 32 | SO 90 | 4.10 | 0.339 | 3.5 | 32.5 | 31.7 | -0.2 | 0.0 | 0.0 |

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# 1994 PROCESSING TOMATO CULTIVAR TRIALS

**TABLE III** **AFTER PROCESS**

| LOT # | CULTIVAR | pH | % ACIDITY | SOLUBLE SOLIDS | AGTRON M E-5M | AGTRON M 35-D RED | AGTRON M 35-D BLUE | AGTRON M 35-D GREEN | AGTRON M 35-D YELLOW |
|---|---|---|---|---|---|---|---|---|---|
| 01 | PS 696 | 3.60 | 0.467 | 4.6 | 40.05 | 33.5 | -2.1 | 1.9 | 1.4 |
| 02 | O 7983 | 3.80 | 0.489 | 4.9 | 37 | 32.9 | -2.1 | 1.9 | 1.3 |
| 03 | O 8245 | 3.90 | 0.512 | 4.1 | 44 | 33.7 | -2.1 | 2.0 | 1.5 |
| 04 | O 8556 | 3.90 | 0.480 | 4 | 43 | 29.3 | -2.0 | 1.8 | 1.3 |
| 05 | H 8704 | 3.75 | 0.550 | 3.3 | 46 | 33.5 | -2.0 | 2.2 | 1.7 |
| 06 | SO 12 | 3.90 | 0.448 | 4.3 | 43.5 | 34.0 | -2.1 | 1.9 | 1.5 |
| 07 | SO 47 | 3.85 | 0.476 | 4.3 | 39 | 33.2 | -2.1 | 2.0 | 1.4 |
| 08 | SO 48 | 3.80 | 0.448 | 4.6 | 38 | 33.3 | -2.1 | 1.8 | 1.3 |
| 09 | OX 38 | 3.80 | 0.435 | 4.15 | 38.75 | 33.5 | -2.1 | 1.7 | 1.2 |
| 10 | OX 42 | 3.90 | 0.422 | 4.4 | 37.5 | 33.0 | -2.1 | 1.6 | 1.1 |
| 11 | OX 52 | 3.80 | 0.473 | 3.9 | 37.5 | 30.7 | -2.1 | 1.8 | 1.3 |
| 12 | OX 64 | 3.70 | 0.480 | 3.7 | 54 | 28.1 | -2.0 | 2.4 | 1.9 |
| 13 | OX 70 | 3.80 | 0.460 | 4 | 38.5 | 30.0 | -2.1 | 1.7 | 1.2 |
| 14 | OX 72 | 3.60 | 0.499 | 3.3 | 51 | 32.6 | -2.0 | 2.2 | 1.7 |
| 15 | OX 88 | 3.70 | 0.556 | 3.7 | 44 | 32.4 | -2.0 | 1.9 | 1.3 |
| 16 | OX 120 | 3.90 | 0.448 | 4.4 | 38 | 32.9 | -2.1 | 1.6 | 1.2 |
| 17 | OX 137 | 3.85 | 0.396 | 4.7 | 34.5 | 32.9 | -2.1 | 1.5 | .9 |
| 18 | 086120 | 3.65 | 0.505 | 4.6 | 38.5 | 33.4 | -2.0 | 1.8 | 1.2 |
| 19 | O87160 | 3.70 | 0.467 | 3.7 | 49 | 32.2 | -2.0 | 2.1 | 1.6 |
| 20 | 087175 | 3.80 | 0.460 | 4.7 | 36.5 | 32.6 | -2.0 | 1.7 | 1.1 |
| 21 | O88119 | 3.70 | 0.326 | 2.65 | 53.2 | 31.4 | -2.0 | 2.2 | 1.7 |
| 22 | O 9241 | 3.90 | 0.435 | 4.3 | 37 | 33.0 | -2.1 | 1.7 | 1.2 |
| 23 | O 9244 | 3.80 | 0.428 | 4.4 | 34 | 32.5 | -2.1 | 1.5 | .9 |
| 24 | E 3020-1 | 3.95 | 0.403 | 3.5 | 38 | 30.7 | -2.1 | 1.6 | 1 |
| 25 | E 3021-1 | 3.60 | 0.531 | 4 | 44 | 33.5 | -1.9 | 2.0 | 1.4 |
| 26 | E 3030-1 | 3.90 | 0.460 | 4.6 | 37 | 33.8 | -2.0 | 1.6 | 1.1 |
| 27 | E 3045-1 | 3.90 | 0.448 | 4.1 | 37 | 33.6 | -2.1 | 1.5 | .9 |
| 28 | E 3071-1 | 3.65 | 0.448 | 4.2 | 36 | 32.7 | -2.0 | 1.5 | 1.0 |
| 29 | E 1838-1 | 3.80 | 0.448 | 4.1 | 34 | 32.5 | -2.1 | 1.5 | 1.1 |
| 30 | E 1849-1 | 3.75 | 0.390 | 4.7 | 33.5 | 32.4 | -2.1 | 1.4 | .9 |
| 31 | | | | | | | | | |
| 32 | H 8704 | 3.75 | 0.550 | 3.3 | 46 | 33.4 | -2.0 | 2.2 | 1.7 |

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